PROC. ENTOMOL. SOC. WASH.
98(1), 1996, pp. 119–121

AN UNUSUAL OCCURRENCE IN WEST VIRGINIA OF STONEFLIES (PLECOPTERA) IN THE PITCHER-PLANT, *SARRACENIA PURPUREA* L. (SARRACENIACEAE)

T. S. Turner, J. L. Pittman, M. E. Poston, R. L. Petersen, M. Mackenzie, C. H. Nelson, and R. M. Duffield

(TST, JLP, MEP, RLP, RMD) Department of Biology, Howard University, Washington, DC 20059, U.S.A.; (MM) U.S. Dept. of Agriculture, Forest Service-Forest Health Protection, 180 Canfield Street, Morgantown, WV 26505, U.S.A.; (CHN) Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN 37403, U.S.A.

Abstract.—Two species of stoneflies, *Leuctra duplicata* Classen and *Leuctra maria* Hanson, were recovered from a population of the American pitcher plant (*Sarracenia purpurea* L.) collected from Big Run Bog, Tucker County, West Virginia. Eight specimens—5 adults, 2 nymphs and 1 exuvium—were recovered from 99 leaves collected in May, 1994. This is the first report of Plecoptera in pitcher plants. This is also the first report of *Leuctra maria* in West Virginia; previous studies indicated it to have a more northern distribution.

Key Words: Plecoptera, stonefly, *Sarracenia,* pitcher plant, aquatic insect, bog, *Leuctra*

Although vegetation of large *Sphagnum*-dominated bogs has been studied extensively in both North America and Europe, limited information exists on plant and animal communities of small *Sphagnum* bogs associated with mountain headwater streams (Damman 1979). Bogs can contain many unusual plant species such as the American pitcher plant, *Sarracenia purpurea* L. This widely distributed species is of interest because it exhibits passive carnivory.

A number of reports document that *S. purpurea* plants trap a diverse variety of insects and other arthropods (Rymal and Folkerts 1982, Bradshaw and Creelman 1984). Nectar guides, in the form of red-purple veins, lead up the brightly colored pitcher-shaped leaves (Joel 1986). These attract insects to the lip where some inadvertently fall into and drown in the water which collects at the base of the leaves and provides nutrition for the plant (Meir et al. 1991). *Sarracenia purpurea* relies on a rich community of bacteria, protozoa and insect larvae for decomposition of trapped prey, enabling absorption of nutrients by the plant (Addicott 1974).

While studying a population of *S. purpurea* in West Virginia, we dissected several leaves and emptied the contents into a petri dish to observe living and dead trapped insects. Because one of the leaves contained an alive adult stonefly (*Leuctra* sp.), an unusual occurrence, we undertook a study to investigate how common stoneflies were to this population of pitcher-plants. Stoneflies were also collected from a nearby stream—a more recognized habitat for them.

Materials and Methods

Location.—The *S. purpurea* population is located in Big Run Bog (also known as

Table 1. Stoneflies (*Leuctra*) specimens recovered from pitcher-plant (*Sarracenia purpurea*) leaves, May, 1994 (M = male, F = female).

Species	Nymphs	Adults	Exuvium
Leuctra duplicata Claassen		2 M: 1 F	
Leuctra maria Hanson	2 mature F	1 M: 1 F	
Leuctra sp.			1
TOTAL	2 mature F	3 M: 2F	1

Olson Bog) located at 39°07″N latitude and 79°35′W longitude, Tucker County, West Virginia. The bog is at an elevation of 980 m above sea level and occupies approximately 20–25 ha in the Monongahela National Forest (Wieder et al. 1981). Big Run Bog is dominated by *Sphagnum* and *Polytrichum* which together cover 85% of the surface (Wieder et al. 1981). *Sarracenia purpurea* was introduced to this bog in 1946 (Strausbaugh and Core 1970) and is well established today.

Methods.—Four mature plants were collected on May 18, 1994, for leaf analysis. Plants were scooped up by hand, placed in plastic pans with water, covered and transported back to the laboratory at Blackwater Falls State Park, West Virginia. Three additional plants were collected for leaf analysis on June 14–15, 1994.

Individual leaves were examined after being removed from the main cluster by cutting at the base with a razor blade and pouring the liquid contents into a petri dish. An accession number was assigned to each leaf and recorded. The leaf was then slit with a razor blade lengthwise, folded open and the solid contents at the base of the leaf were removed with a spatula and placed in 70% ethanol. Live Diptera larvae remaining on the leaves as well as those in the liquid contents were removed with forceps and placed in the alcohol and labelled. Ninety-nine leaves were analyzed from the May collections and forty-seven leaves from the June collections.

Once all the samples were collected, the dead stonefly specimens were removed from samples and placed in separate vials for later identification.

Approximately 200 meters from the pitcher plant site, a small stream ran into the bog. During both May and June, adult stonefly specimens in the vicinity of the stream were collected by net and by using a beating sheet.

Results and Discussion

Two species of stoneflies, *Leuctra duplicata* Claassen, and *Leuctra maria* Hanson, were recovered from the leaf samples (Table 1). All were from samples collected in May. A total of 8 stonefly specimens were found including 2 nymphs, 5 adults and 1 exuvium. One leaf contained one *L. maria* adult and one *Leuctra* sp. exuvium. Although 47 leaves were inspected in June, no Plecoptera were recovered.

Leuctra maria has not previously been reported in West Virginia. It is reported to have a more northern distribution (Stark et al. 1986). This uncommon species is poorly represented in collections.

More species of Plecoptera were found in the hand-collected material than were recovered from the *S. purpurea* leaves (Table 2). The stream samples contained 7 species: one from the family Nemouridae, namely, *Ostrocerca albidipennis* (Walker), and six species of *Leuctra* from the family Leuctridae.

The occurrence of two species of Plecoptera, and in particular, *Leuctra maria,* in pitcher-plants is unexpected. Although a variety of insects have been associated with *S. purpurea* (Bradshaw and Creelman

Table 2. Adult stoneflies (Plecoptera) collected by net and beating sheet near the *Sarracenia purpurea* site (M = male, F = female).

Family/Species	May 17–18	June 14–15
Nemouridae		
Ostrocerca albidipennis (Walker)	4 M: 18 F	1 F
Leuctridae		
Leuctra biloba Claassen	12 M: 16 F	1 M
Leuctra duplicata Claassen	13 M: 16 F	79 M: 63 F
Leuctra ferruginea (Walker)		18 M: 35 F
Leuctra maria Hanson	16 M: 17 F	35 M: 17 F
Leuctra sibleyi Claassen	16 M: 15 F	
Leuctra triloba Claassen		14 M: 18 F

1984), this is the first report of a stonefly species.

Stoneflies are generally associated with running water, not bogs. While it is possible that the adults were trapped after being blown by the wind to the pitcher-plant site or by flying or walking there, the presence of mature nymphs in the leaves is puzzling. One explanation is that these species live in the waters of the bog where they complete their life cycles. A more likely possibility is that these species spend much of their life cycle in the nearby stream. During spring, however, when the water level in the bog is high from snow melt and rain, some nymphs could disperse throughout the bog. In the process of emerging, the mature nymphs may climb out of the water onto the pitcher-plant leaves, with a few becoming trapped in the plants.

Acknowledgments

This study was initiated during a summer Forest Biology and Ecology Field Course sponsored by the U.S.D.A.-Forest Service (Eastern Region) through a memorandum of understanding with Howard University. We thank Bill Woodland, District Ranger, Cheat District, Monongahela National Forest for the coordination and logistical support of the field course and Dr. Mary Beth Adams (Project Leader, Sustainable Forest Ecology in Central Appalachian Forests) for assisting with teaching in the field course.

Literature Cited

Addicott, J. F. 1974. Predation and prey community structure: an experimental study of the effect of mosquito larva on the protozoan communities of pitcher plants. Ecology 55: 475–492.

Bradshaw, W. E. and R. A. Creelman. 1984. Mutualism between the carnivorous purple pitcher plant and its inhabitants. American Midland Naturalist 112: 294–304.

Damman, A. W. H. 1979. Geographic patterns in peatland development in Eastern North America. Proceedings of the International Symposium on the Classification of Peat and Peatlands, Hyytiala, Finland, pp. 42–57.

Joel, D. M. 1986. Glandular structures in carnivorous plants: their role in mutual exploitation of insects, pp. 219–234. *In* Juniper, B. E. and T. R. E. Southwood (eds.), Insects and the Plant Surface. Edward Arnold, London.

Meir, P., B. E. Juniper, and D. E. Evans. 1991. Regulation of free calcium concentration in the pitchers of the carnivorous plant *Sarracenia purpurea*: A model for calcium in the higher plant apoplast. Annals of Botany 68: 557–561.

Rymal, D. E. and G. W. Folkerts. 1982. Insects associated with pitcher plants (*Sarracenia:* Sarraceniaceae), and their relationship to pitcher plant conservation: A review. Journal of the Alabama Academy of Science 53: 131–151.

Stark, B. P., S. W. Szczytko and R. W. Baumann. 1986. North American stoneflies (Plecoptera): Systematics, distribution, and taxonomic references. Great Basin Naturalist 46: 383–397.

Strausbaugh, P. D. and E. L. Core. 1970. Flora of West Virginia, 2nd ed. Seneca Books, Inc. Grantsville, West Virginia. 1079 pp.

Wieder, R. K., A. M. McCormick, and G. E. Lang. 1981. Vegetational analysis of Big Run Bog, a nonglaciated *Sphagnum* bog in West Virginia. Castanea 46: 16–29.